

WEATHER, FORECASTS, AND WARNINGS FOR THE MONTH.

By EDWARD H. BOWIE, in charge of Forecast Division.

The prominent meteorological feature of the month was the cool wave that passed eastwardly over the country during the third decade. It gave the lowest temperatures of record for the month of August, with frosts, in the northern Rocky Mountain region and the middle and northern Plains States, and light frosts in the interior of New York and New England.

Good rains fell over much of the country east of the Rocky Mountains during the month, while in the northern Rocky Mountain region and the Pacific States drought was general. Forest fires passed over large areas in the northern Rocky Mountain region, and according to press reports caused the destruction of a large acreage of timber. The production of precipitation by artificial means was agitated and it was urged that the guns of the Army and Navy be employed in an effort to accomplish this. The question was referred to Prof. Willis L. Moore, Chief of the U. S. Weather Bureau, by the War Department and he replied as follows:

WASHINGTON, D. C., August 25, 1910.

General LEONARD WOOD,
Chief of Staff,
Washington, D. C.

MY DEAR GENERAL: I have the honor to return herewith the letter Mr. Arthur Brisbane addressed to the President, and to render the following report on the feasibility of Mr. Brisbane's scheme of liberating dust particles in the upper air for the purpose of forming nuclei on which condensation might begin in the process of artificially creating rainfall. Under separate cover I send your a copy of my text book on "Descriptive Meteorology," which has just come from the Appleton press. By signing the inclosed receipt you may retain the book for your official library, if you so desire. I would call your attention to chapter 3 of the book, which explains the process of condensation as affected by the dust motes in the air, and to chapter 12, which treats of precipitation. I have given much time to the investigation of the problem of creating rainfall artificially. It is true, as Mr. Brisbane says, that there is no rainfall in free air, except when dust motes furnish the "free surfaces" on which condensation may begin, and that in the absence of dust motes, as has frequently been demonstrated in the laboratory, it is impossible to produce condensation, even though the atmosphere be largely supersaturated. Aitken has made experiments in which he entrapped optically pure (dust free) air and after saturating the air has been able to create a miniature rainstorm by the liberating of fine dust particles inside the inclosure. But unfortunately for the theory of Mr. Brisbane, while dust is an absolute necessity for the creation of rainfall the presence of dust in large quantities does not create rainfall. In fact during long periods of drought the air is more highly charged with matter in suspension in the form of dust motes than at any other time, and the drought may continue for weeks or months while the quantity of dust increases. As you may see from the table at the bottom of page 36 of my book, extensive measurements have shown that even when it is raining there are 32,000 dust motes per cubic centimeter, and that when it is fair there are, at least, 100,000, and that even at the top of a high mountain when the wind is blowing away from a large city, the number is, at least, 1,600 per cubic centimeter. It is apparent, therefore, that there is always an abundance of dust motes, which, I will say for Mr. Brisbane's information, are far below the most powerful magnifying glass. They can only be detected by Aiken's condensation dust counter, which is described in full on pages 32 to 37 of my book.

The main difficulty in creating rainfall by the method that Mr. Brisbane suggests is this: Either the amount of the vapor content must be increased, or the temperature lowered. Mr. Brisbane speaks of distributing liquid air for the purpose of lowering the temperature aloft so that condensation may begin, but he fails to realize that the amount of energy necessary to manufacture enough liquid air to have any appreciable effect on the enormous quantity of heat that would have to be met would probably take the combined energy of all the stationary and active engines in the city of New York, and millions of balloons, in order to affect a quantity of air sufficient to produce even the most moderate sprinkle of rain. It is my opinion that the processes of nature are on such a stupendous scale as to render ineffective any efforts of man to artificially create rain in paying quantities in the free atmosphere. Of course we can artificially produce it in various ways in the laboratory. We have dust in abundance, but man is unable to appreciably lower the temperature of such a great amount of air as is concerned in the production of any ordinary summer thundershower.

I am sorry I can not give a more favorable report, as I do not like to discourage the entering into science of such a talented man and lucid thinker as Arthur Brisbane.

Very respectfully,

(Signed) WILLIS L. MOORE,
Chief, U. S. Weather Bureau.

(Inclosure.)

A disturbance that appeared over Alaska at the close of July advanced eastwardly along the northern border, passing over the Great Lakes on the 3d, attended by showers and thunderstorms and brisk south, shifting to west, winds, and reaching the St. Lawrence Valley on the 4th. This disturbance was followed by a general change to lower temperature, which overspread practically all parts of the country east of the Rocky Mountains and terminated the period of excessively high temperatures in the Middle West. The area of high barometric pressure was accompanied by unseasonably low temperatures in the upper Lake region and the upper Mississippi Valley, and on the 4th light frosts occurred in the cranberry marshes of Wisconsin. Warnings of the occurrence of these frosts were issued on the morning of the 3d.

The forecast for the first week of August, issued Sunday, July 31, follows:

The distribution of barometric pressure over the North American Continent and the adjacent oceans is such as to indicate that there will be no general warm wave over the United States during the week beginning August 1. Temperatures will be moderate for the season over the eastern half of the country during the first part of the week, followed by a change to somewhat higher temperature in the Mississippi Valley Tuesday and in the Eastern States Wednesday. In the Northwestern States, the Rocky Mountain and Plateau regions, temperatures will be near or somewhat below the seasonal average. A disturbance will move eastward from the Rocky Mountain region Monday or Tuesday and reach the Atlantic States by Thursday, the 4th. It will be preceded and attended by unsettled weather and showers and be followed by a change to lower temperature.

The mean temperature for the week was generally below the normal by small amounts over the entire northern and western portions of the country, while over the southern portions of the Great Plains region and thence eastward over the Southern States to the Atlantic coast it was slightly above the normal. Showers were frequent and the rainfall above the normal during the week in the South Atlantic and Gulf States, the lower Mississippi Valley and the Plains States, and the Rocky Mountain region, and fairly well-distributed rains occurred in the Lake region and New England.

The special weekly forecast issued Sunday, August 7, was to the effect that there would be no abnormally high temperatures throughout the country during the week beginning August 8, and that a disturbance would move eastward from the Middle West during the first part of the week and cause showers over the eastern half of the country.

Generally unsettled, cloudy weather prevailed at the beginning of the week over the districts east of the Rocky Mountains, with local showers in the Missouri Valley and over portions of the Gulf and South Atlantic States. Local rains continued at intervals during the next 3 days, followed by a short period of fair weather, attending an area of high barometric pressure that moved eastwardly from the Northwestern States and reached the Atlantic coast at the close of the week. On the 12th and 13th, local rains again set in over the east Gulf and South Atlantic States, and showers and thunderstorms occurred at many points from the upper Lake region southwestward to the Rocky Mountain region. The weekly rainfall was above the normal in the upper Mississippi Valley, the Plains States, the middle Rocky Mountain region, and over portions of the Gulf and Atlantic States. Temperatures during the week were below the normal over the interior of the country and the Pacific coast States, and were above the normal by small amounts from the extreme upper Mississippi Valley eastward over the Great Lakes to northern New England, over Texas, and on the middle Gulf coast.

An extensive area of low barometric pressure passed eastward over Europe to Siberia during the week ending the 14th; it was attended by general rains, and at the close of the week another storm area was approaching the British Isles.

On the 14th the following weekly forecast was issued:

The distribution of barometric pressure over the North American Continent and the Atlantic and Pacific oceans is such as to indicate that there will be a continuation of temperatures near or slightly below the normal over the greater part of the country during the week beginning August 15. A disturbance will form over the Rocky Mountain region during Monday and move eastward attended by unsettled weather and showers and reach the Atlantic States by the middle of the week. It will be followed by fair and cool weather.

The barometric pressure was abnormally low and the weather unsettled and showery during the week beginning on the 15th over the British Isles and northern Europe, and a disturbance passed easterly through Siberia; this disturbance was of marked intensity and the barometric pressure at its center on the 17th was near 29.00 inches. Conditions in the West Indies during the first part of the week were unsettled and there were faint indications of a disturbance on the 14th in the vicinity of Barbados; it, however, did not develop into a well-defined storm. In connection with the slight barometric depression noted in the eastern Caribbean Sea on the 14th, the following extract from the log of the British S. S. *Ceareuse*, Capt. W. Davies, voyage New York to Barbados, is of interest:

When northward of Barbados on August 11, the whole sky was covered with a thin watery film of cirro-stratus clouds. During the following night we experienced frequent squalls with rain. The squalls commenced with sharp gusts of wind lasting about 5 minutes, followed by periods of calm and heavy rains, with steady barometer. On the 12th, at 8 a. m., slight sea swell from the southeast gradually increased as the day advanced, but did not reach the height of a swell in the front of a storm. Between noon and 1 p. m. the barometer dropped from 29.90 to 29.85 and a heavy bank of cumulus clouds appeared in the horizon from the northeast through east to south; wind northeast by east and force 5 or 6. I assumed that a hurricane was passing in the vicinity some distance to the south and west. Throughout the day the wind backed slowly toward the southeast and after sunset there were terrific squalls with heavy rains.

In the United States the temperature at the beginning of the week was near the normal in all districts, but cooler weather overspread the extreme Northwestern States and by Wednesday had advanced to the upper Missouri Valley, with temperatures below 40° in portions of Montana, Wyoming, and North Dakota, and at exposed points in the northern Rocky Mountain region temperatures were near freezing, with frosts, which were successfully forecast. The cool wave moved eastward, gradually overspreading the Mississippi and Ohio valleys, the Lake region, and the Atlantic States by the close of the week. Toward the end of the week warmer weather overspread the western districts, and by the close of the week had advanced into the central valleys. The area of low barometer referred to in the weekly forecast of the 14th advanced eastward and caused good rains in nearly all districts from the Plains States to the Atlantic coast.

The forecast issued Sunday, the 21st, was as follows:

The indications are that warm weather will prevail during the greater part of the coming week in the Eastern States and during the first part of the week in the Middle West. A change to cooler weather will overspread the Northwestern States Tuesday or Wednesday and advance thence eastward to the Eastern States by the close of the week. A disturbance will appear in the Northwest Monday or Tuesday and move eastward, attended by unsettled weather and local rains, and reach the Atlantic States during the latter part of the week. Showers will continue the greater part of the week in the Southeastern States.

During this week in the United States the prominent meteorological feature was the cool wave that passed eastwardly over the country from the Canadian Northwest. It gave the lowest temperatures of record for the month of August in the northern Rocky Mountain region and the Plains States, and snow in Wyoming and western Montana; it caused frosts in Idaho, Montana, Wyoming, Colorado, Nebraska, North Dakota, Minnesota, and Wisconsin, and light frosts at exposed places in New England and New York. Frost warnings were issued in ample time for precautionary measures to protect, where possible, growing crops.

In connection with the forecasting of this cool wave the following extracts from the press from widely separated points are taken:

The day was a great triumph for the weather man. The particular prophet in this case was Prof. Willis L. Moore, head of the Bureau at Washington. And the prophecy was on long time, as weather forecasts go. It was made last Sunday. It was accurate to the hour and to distance, direction, and temperature; geographically correct—absolutely exact.

The Sunday forecast said that the wave would start in the Northwestern States and sweep east across the country. For Oklahoma and vicinity Thursday was the day set for the cold spell, and the cold spell came. No one but the doubter was disappointed. * * *—*From the Oklahoman, Oklahoma City, Okla.*

The present remarkably cool weather for this season of the year was accurately forecast by the United States Weather Bureau 1 week in advance. * * *—*From the Courier-Journal, Louisville, Ky.*

The Weather Bureau at Washington predicted last Sunday that a cold wave would strike this vicinity about the middle of the week, didn't it? And it said that the cold wave would be preceded by very hot weather. * * * The long-distance forecasting department of the Washington Weather Bureau scored one of the biggest tallies in its history Thursday morning when the cold wave came along. * * *—*From the Springfield Republican, Springfield, Mo.*

The official forecaster's reputation as a successful long-range forecaster is better than ever in this vicinity. His cool wave for the East, predicted a week ago, arrived last night on scheduled time, and the temperature consequently was "in the dumps" over night. There were no frost bites, to be sure, but the drop in temperature was sufficient to justify the "cool wave" forecast. * * *—*From the Transcript, Boston, Mass.*

The observer on last Monday morning published a weather prediction issued from Washington, D. C., stating that chilly blasts would sweep across the country during the week. * * * This forecast was read by many, but most people straightway dismissed it from their minds. During the week, however, there followed such a remarkably accurate verification of the prediction made days before the cold started, that the public sat up and took notice. * * * It only affords another striking illustration of the remarkable progress being made in the development of the weather science, and shows also what an excellent and highly valuable service is being given by the Government in this department. * * * The wave advanced true to form and reached the Atlantic by Saturday morning. It pays to listen to the weather man.—*From the Daily Observer, Charlotte, N. C.*

The precipitation during the week beginning August 22, was confined as a rule to local showers at widely scattered points. Some heavy rains occurred over the upper Lake region during the early and middle portions of the week and in the lower Ohio Valley and along the Gulf and south Atlantic coasts during the middle and latter part of the week.

A disturbance that appeared in the Northwest Tuesday, the 23d, moved eastward to the north Atlantic coast on Friday, and during its passage over the Great Lakes it caused southwest, shifting to northwest, gales. Storm warnings had been ordered for the Great Lakes previous to the occurrence of these high winds and no reports of loss to shipping in connection with this storm are of record.

A tropical storm of moderate intensity developed over the eastern portion of the Caribbean Sea on the 23d and after moving westward, it passed northwestward over the Bahama Islands to a position a considerable distance off the Georgia coast, where its recurve to the northeast was obstructed by high pressure to the north and east, and it was forced inland over Georgia and the Carolinas, causing torrential rains on the 29th and 30th. Wireless reports from vessels off the south Atlantic coast while this storm prevailed, were to the effect that high winds and seas, and heavy rains were in progress. Advisory warnings were sent to ports on the Atlantic and Gulf coasts daily following the appearance of this disturbance in the West Indies, and no loss of vessels or lives has yet been reported. While the disturbance was in progress off the south Atlantic coast another storm developed over the middle Gulf and moved thence westward and passed inland near the mouth of the Rio Grande, on the 31st. Advisory warnings were issued on the 27th and northeast storm warnings were ordered for the Texas coast the morning of the 30th. High winds and high tides were experienced along the lower Texas coast, and there was some damage to property in the vicinity of Brownsville.

The following remarks from the Corpus Christi Daily Caller of August 31 referred to the work of the Bureau in connection with this storm:

On account of boisterous seas and unfavorable weather reports, the *Grey Fox* yesterday hugged Central Pier, not venturing forth on her customary visit to Tarpon. Several other boats, mostly fishing craft, were deterred from sailing by the red flags floating from the United States signal pole. This is one of many concrete examples of the value of the Weather Bureau.

The international weather charts prepared daily at the Central Office showed unusual weather conditions over many parts of the Northern Hemisphere during the week that ended the 28th. Stormy weather prevailed much of the week over Europe and the British Isles, and a disturbance of marked intensity passed eastward through Siberia to the Bering Sea.

On the 28th the following weekly forecast was issued.

The distribution of barometric pressure over the Northern Hemisphere is such as to indicate that temperatures near or below the normal will prevail over the greater part of the United States during the week beginning the 29th. A disturbance will appear in the Northwest Monday or Tuesday and move eastward, attended and preceded by unsettled, showery weather and rising temperature, and reach the Atlantic States by the latter part of the week. This disturbance will be followed by cooler, with a probability of frosts in the Northwest. Unsettled weather is indicated for the first part of the week along the south Atlantic and Gulf coasts.

Rains occurred over practically all parts of the country in connection with this disturbance, and showers on several days in the far Northwest extinguished the forest fires that were in progress in that region. Light frosts and freezing temperatures were reported from the northwest during the first part of the week.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England.....	80	- 2	Missouri Valley.....	69	+ 2
Middle Atlantic.....	78	+ 7	Northern slope.....	53	+ 1
South Atlantic.....	85	+ 3	Middle slope.....	66	+ 7
Florida Peninsula.....	81	+ 1	Southern slope.....	59	+ 2
East Gulf.....	79	- 1	Southern Plateau.....	48	+ 6
West Gulf.....	72	- 3	Middle Plateau.....	38	+ 5
Ohio Valley and Tennessee.....	71	- 1	Northern Plateau.....	33	+ 10
Lower Lakes.....	69	- 2	North Pacific.....	76	+ 9
Upper Lakes.....	75	0	Middle Pacific.....	56	- 11
North Dakota.....	65	+ 1	South Pacific.....	63	- 3
Upper Mississippi Valley.....	70	0			

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England.....	5.4	+ 0.4	Missouri Valley.....	4.5	+ 0.4
Middle Atlantic.....	5.8	+ 0.7	Northern slope.....	4.3	+ 0.4
South Atlantic.....	5.9	+ 0.7	Middle slope.....	4.6	+ 1.0
Florida Peninsula.....	5.2	0.0	Southern slope.....	3.9	0.0
East Gulf.....	5.0	- 0.2	Southern Plateau.....	3.6	- 0.1
West Gulf.....	3.9	- 0.1	Middle Plateau.....	2.9	- 0.4
Ohio Valley and Tennessee.....	4.4	- 0.1	Northern Plateau.....	2.0	- 0.3
Lower Lakes.....	4.7	+ 0.1	North Pacific.....	5.1	- 0.2
Upper Lakes.....	5.7	+ 1.0	Middle Pacific.....	3.4	0.0
North Dakota.....	4.9	+ 0.9	South Pacific.....	2.1	- 0.5
Upper Mississippi Valley.....	5.0	+ 0.8			

RIVERS AND FLOODS.

By Prof. H. C. FRANKENFIELD, in charge River and Flood Division.

The month of August marks the definite inauguration of the low-water season over the greater portion of the country, and during the present month conditions were much accentuated by the persistence of the drought over the northern half of the country from the Atlantic to the Pacific.

In many sections west of the Mississippi River the August stages were the lowest of record, while in the upper Mississippi River the stages, although not unprecedented, were sufficiently low to entirely demoralize navigation above the mouth of the Missouri River. The lower Missouri continued at a fair stage

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
New England.....	12	66.2	- 0.9	+13.5	+ 1.7
Middle Atlantic.....	15	71.8	- 0.8	+ 9.0	+ 1.1
South Atlantic.....	10	77.6	- 0.2	+ 2.5	+ 0.3
Florida Peninsula*.....	8	80.9	- 0.6	- 2.9	- 0.4
East Gulf.....	11	80.2	+ 1.0	- 1.0	- 0.1
West Gulf.....	10	82.8	+ 2.0	+ 4.4	+ 0.6
Ohio Valley and Tennessee.....	13	74.4	- 0.4	- 0.7	- 0.1
Lower Lakes.....	10	69.6	+ 0.1	+ 7.3	+ 0.9
Upper Lakes.....	12	66.4	+ 0.4	+19.0	+ 2.4
North Dakota*.....	6	62.7	- 3.6	+23.6	+ 3.0
Upper Mississippi Valley.....	14	72.8	- 0.1	+ 9.9	+ 1.2
Missouri Valley.....	12	72.5	- 1.3	+14.8	+ 1.8
Northern slope.....	9	64.1	- 2.6	+20.4	+ 2.6
Middle slope.....	6	74.8	- 0.4	+15.4	+ 1.9
Southern slope*.....	8	81.5	+ 1.9	+10.9	+ 1.4
Southern Plateau*.....	10	77.3	+ 1.3	+11.6	+ 1.4
Middle Plateau*.....	10	69.3	- 0.3	+10.2	+ 1.3
Northern Plateau*.....	10	65.2	- 2.6	+ 9.5	+ 1.2
North Pacific.....	7	58.4	- 2.7	- 2.2	- 0.3
Middle Pacific.....	7	65.3	- 1.5	- 1.9	- 0.2
South Pacific.....	4	70.4	- 0.1	+ 8.0	+ 1.0

*Regular Weather Bureau and selected cooperative stations.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
New England.....	11	Inches. 2.38	66	Inches. - 1.2	Inches. - 3.3
Middle Atlantic.....	15	2.55	59	- 1.8	- 3.8
South Atlantic.....	11	9.00	148	+ 2.9	+ 3.5
Florida Peninsula*.....	8	6.53	94	- 0.4	- 6.0
East Gulf.....	11	3.63	73	- 1.3	- 4.5
West Gulf.....	10	2.12	70	- 0.9	- 5.3
Ohio Valley and Tennessee.....	13	2.01	59	- 1.4	- 1.0
Lower Lakes.....	10	2.47	83	- 0.5	- 1.9
Upper Lakes.....	12	3.41	113	+ 0.4	- 4.7
North Dakota*.....	6	1.61	67	- 0.8	- 6.4
Upper Mississippi Valley.....	15	2.88	91	- 0.3	- 6.7
Missouri Valley.....	12	4.81	141	+ 1.4	- 4.4
Northern slope.....	9	0.83	87	- 0.4	- 2.8
Middle slope.....	6	3.67	149	+ 1.2	- 4.4
Southern slope*.....	8	2.36	96	- 0.1	- 7.9
Southern Plateau*.....	9	1.31	81	- 0.3	- 2.1
Middle Plateau*.....	11	0.55	73	- 0.2	- 4.0
Northern Plateau*.....	10	0.21	41	- 0.3	- 2.7
North Pacific.....	7	0.21	38	- 0.6	- 3.0
Middle Pacific.....	7	0.00	100	0.0	- 5.8
South Pacific.....	4	0.01	100	0.0	- 4.9

*Regular Weather Bureau and selected cooperative stations.

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Chicago, Ill.....	23	60	ne.	Sioux City, Iowa.....	2	65	n.
Jacksonville, Fla.....	12	56	s.	Do.....	29	54	nw.
Oklahoma, Okla.....	3	52	s.	Toledo, Ohio.....	23	50	s.
Point Reyes Light, Cal.....	28	64	nw.	Do.....	25	53	sw.
Roswell, N. Mex.....	13	52	nw.	Williston, N. Dak.....	29	50	w.
Salt Lake City, Utah.....	27	60	w.				

and for this reason only was navigation possible between St. Louis and the mouth of the Ohio River.

More detailed accounts of the low water will be found in the reports of the various district editors.

The effects of the drought were also experienced in the South Atlantic States where low stages prevailed at a time of the year when floods are by no means infrequent. The only semblance of a flood was one that resulted from heavy rains on the last two days of the month over the watershed of the Santee River. These rains caused a rapid rise in the various tributary streams